HÖGSKOLAN I GÄVLE

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PROGRAMME SYLLABUS

FIRST CYCLE

STUDY PROGRAMME IN ENVIRONMENTAL ENGINEERING, CO-OP
Programme Code: TGMIK
Established by the Faculty Board
2010-10-27

Programme Syllabus

Study Programme in Environmental Engineering, Co-op, 180 HE credits

(Miljöteknik – inriktning vatten, återvinning och energi, Co-op, 180 hp)

This programme syllabus applies to students admitted to the autumn semester of 2011 or later.

STUDY PROGRAMME IN ENVIRONMENTAL ENGINEERING, CO-OP at Högskolan i Gävle

1 General Arrangement

The Study Programme in Environmental Engineering, Co-op, includes 180 HE credits and results in a bachelor's degree. With supplementary qualification in mathematics, the requirements for a Bachelor of Science in Engineering may be achieved. The programme contains courses in the main fields of environmental engineering, industrial management, energy systems, chemistry and business administration. The programme's main field of study is environmental engineering. The education is designed in collaboration with companies in relevant sectors. Through the education, the students will acquire knowledge that enables working with issues in the fields of cycles and sustainable development, which includes e.g. waste disposal and environmental management. Within the areas of water and waste water and logistics, today's technical solutions in relevant activities are studied. Project work dominates the education, and the different roles of a project group are in focus.

The programme may be studied as a traditional first-cycle education or as Cooperative Education, Co-op. Co-op implies that students alternate studies and work during scheduled work periods. A work period of 10 weeks is included in each academic year. A total of four work periods during the four years of studies are included. The education provides the qualification needed for second-cycle studies.

2 Expected Learning Outcomes

2.1 Expected Learning Outcomes for First-cycle Programmes According to the Higher Education Act, Chapter 1, Section 8, and Qualification Descriptor According to the Higher Education Ordinance, Appendix 2

2.1.1 Expected Learning Outcomes for First-cycle Programmes According to the Higher Education Act, Chapter 1, Section 8

First-cycle studies should essentially expand upon the knowledge that pupils acquire on national or specially designed programmes in upper-secondary school, or equivalent knowledge. The government may, however, grant exemptions regarding programmes in fine, applied and performing arts.

First-cycle studies should develop the students

- ability to make independent and critical assessments
- ability to independently discern, formulate and solve problems, and
- preparedness to address changes in the working life.

Within the field of the education, the students should, in addition to knowledge and skills, develop the ability to

- search and evaluate knowledge on an academic level
- follow the knowledge development, and
- exchange knowledge also with individuals without expertise in the area

2.1.2 Qualification Descriptor According to the Higher Education Ordinance, Appendix 2

Bachelor's Degree

Extent
A bachelor's degree is achieved when the student has successfully completed course requirements of 180 HE credits with a certain specialisation decided by each higher education institution, including at least 90 HE credits of progressive specialisation in the programme's main field of study.

Expected Learning Outcomes
Knowledge and Understanding
For a bachelor's degree, the student should

- demonstrate knowledge and understanding of the programme's main field of study, including knowledge of the disciplinary foundation of the field, knowledge of applicable methods in the field, advanced studies in some part of the field and an orientation in current research questions.

Skills and Abilities
For a bachelor's degree, the student should

- demonstrate the ability to search, collect, evaluate and critically interpret relevant information in a problem, and to critically discuss phenomena, issues and situations,
- demonstrate the ability to independently identify, formulate and solve problems and to carry out assignments within given time frames,
- demonstrate the ability to account for and discuss information, problems and solutions in dialogue with different groups, orally and in writing, and
- demonstrate the skills required to work independently within the field of the education.

Judgement and Approach
For a bachelor's degree, the student should

- demonstrate the ability to make assessments with considerations to relevant scientific, social and ethical aspects, within the programme's main field of study,
- demonstrate an understanding of the role of knowledge in society and of people's responsibility for how it is used, and
- demonstrate the ability to identify the own need of additional knowledge and to develop the own skills.

Thesis (degree project)
For a bachelor's degree, the student must have successfully completed an individual assignment (degree project) of at least 15 HE credits, within the framework of the course requirements and the programme's main field of study.

Other
For a bachelor's degree with a certain specialisation, the specific requirements decided by each higher education institution within the framework of the requirements in this qualification descriptor, should also apply.

2.1.3 Bachelor of Science in Engineering

Extent
Bachelor of Science in Engineering is achieved when the student has successfully completed required courses of 180 HE credits.

Expected Learning Outcomes
For a Bachelor of Science in Engineering, the student should demonstrate the knowledge and abilities required to work independently as an engineer.

Knowledge and Understanding
For a Bachelor of Science in Engineering, the student should

- demonstrate knowledge of the disciplinary foundation of the chosen field of technology and its best practice, and knowledge of current research and development
- demonstrate a broad expertise in the chosen field of technology, and relevant knowledge in mathematics and natural sciences

Skills and Abilities
For a Bachelor of Science in Engineering, the student should:

- demonstrate the ability to independently and creatively identify, formulate and handle issues and analyse and evaluate different technical solutions, with a comprehensive view
- demonstrate the ability to plan and, with adequate methods, carry out assignments within given frames
- demonstrate the ability to critically and systematically use knowledge, and to model, simulate, predict and evaluate developments based on relevant information
- demonstrate the ability to design and handle products, processes and systems with consideration to the conditions and needs of people and the targets of society for economic, social and ecological sustainable development
- demonstrate the ability to work in teams and cooperate in groups with different compositions
- demonstrate the ability to account for and discuss information, problems and solutions in dialogue with different groups, orally and in writing

Judgement and Approach
For a Bachelor of Science in Engineering, the student should:

- demonstrate the ability to make assessments considering relevant scientific, social and ethical aspects
- demonstrate an understanding of the possibilities and limitations of technology, its role in society and people's responsibility for its use, including social and economic aspects and environmental and working environment aspects
- demonstrate the ability to identify the own need of additional knowledge and to continuously develop the own skills

Thesis (degree project)
For a Bachelor of Science in Engineering, the student must have successfully completed an individual assignment (degree project) of at least 15 HE credits, within the framework of the required courses.

Other
For a Bachelor of Science in Engineering, the specific requirements decided by each higher education institution within the framework of the requirements in this qualification descriptor should also apply.

2.2 Specific Expected Learning Outcomes for the Programme

Knowledge and Understanding
After the education, the student should:

- be able to describe the basics of water and waste water systems, waste disposal, logistics, energy, environmental management, environmental assessment and economics
- be able to describe some of the most common systems for water and waste water and waste disposal on system and component level
- be able to account for the physical driving forces of the cycles, and how the cycles of different substances are affected by biogeochemical processes
- be able to account for current environmental legislation, professional associations and their roles, and also laws and rules (national and EU directives)
- be able to account for the environmental impact of society and the interplay with the surrounding ecosystem and its global cycle
- be familiar with the forms of scholarly communication and publication.

Skills and Abilities
After the education, the student should:

- be able to independently analyse, develop and evaluate system for water, waste water and waste disposal, regarding environmental impact and costs
- be able to independently analyse how a change on component level in these systems affects the function and energy efficiency of the systems
- be able to analyse technical and natural cycles from a systems perspective, and process integration of the systems for water and waste water, energy and waste
- be able to map complex technical cycles, design these regarding the environmental impact in a life-cycle perspective, and analyse and evaluate these from a business administration and environmental economic perspective.
- demonstrate the ability to work with environmental impact assessments, methods for environmental management and auditing, and modelling and simulation
- be able read and understand advanced literature in the area of environmental engineering.

Judgement and Approach
After the education, the student should:

- show an approach to knowledge and lifelong learning characterised by an active, responsible and self-reflecting method of study, by applying social, economic and environmental perspectives on the work
- be able to discuss questions with a comprehensive view on the interplay between the activities of society and the surrounding ecosystem
- demonstrate the ability to systematically formulate, solve and present problems from a life-cycle perspective in an educational way, orally and in writing
- be able to critically evaluate information.

3 Description of the Programme

3.1 Main Field of Study

3.1.1 Main Field of Study Environmental Engineering

The programme's main field of study is environmental engineering. Environmental Engineering is a broad subject with applications in the several other subject areas, such as building technology, energy technology, industrial management, material science, chemistry, biology etc. The parts of environmental engineering applicable in the programme are described here.

The basics of environmental engineering are focussed on work science and environmental technology, cycles, waste disposal and environmental impact assessment. Supplementary studies are included in industrial environmental management, environmental assessment of energy systems and through a major project in the field of environment, water and energy. The specialisation occurs through studies in life-cycle analysis, implementation of a synthetic project in cycles and sustainable development, and a scientific theory and method course. The programme ends with a degree project. The degree project is carried out in concentrated form at the end of the education. Through the degree project, knowledge acquired during previous studies should be applied, broadened and advanced. Through the degree project, the students should show that the expected learning outcomes for first-cycle programmes stated in the Higher Education Act, the expected learning outcomes stated in the Higher Education Ordinance and the specific expected learning outcomes stated in this programme syllabus have been achieved.

3.2 Teaching and Examination

3.2.1 Teaching

The educational view is based on the fact that all learning is an active, dynamic process which takes place in collaboration between teachers and students. All teaching and supervision should be based on that the student takes own responsibility for the studies and for actively seeking knowledge. In that way, the student is given the opportunity to develop personally, which is of great importance for the future profession and a lifelong learning. The student will also be prepared to address changes and learn to review the own knowledge to be able to participate actively in the development and evaluation of the profession. Different teaching and working methods should teach the student to actively search for knowledge, critical thinking, reflection and oral and written proficiencies and in using academic literature.

The scheduled teaching is given as lectures, teaching sessions, laboratory sessions, field exercises, project work and seminars. Parts of the teaching are carried out as group work. Attendance is compulsory at certain teaching parts. Apart from the scheduled teaching, self-studies occur.
The progression of the education occurs through a progressive specialisation in the chosen field of technology, both through in-depth subject studies and development of the scholarly approach.

3.2.2 Examination

Varying examination formats are applied in the programme courses. The format is adapted to the different course requirements on examination formats. Both written and oral tests occur, individually and in groups. The design, extent and duration of the tests are adapted to

the expected learning outcomes for the respective courses. Examination should also be put in relation to the demands of the working life on demonstrated knowledge and skills.

3.3 Cooperative Education, Co-op

The programme may be read as a traditional higher education, which results in a Bachelor of Arts or a Bachelor of Science in Engineering of three years, or as Cooperative Education (Co-op), which takes four years. Co-op implies that the student alternates studies and work during the planned work periods. The co-op positions are limited and the higher education institution cannot guarantee a position at any of the companies linked to the higher education institution, and the company decides if the student's application and interview lead to employment during the education. Students who do not receive a Co-op position will study for three years instead for four. The first semester will provide more information about Co-op and how to apply for Co-op positions. The Co-op students' experiences will be utilised in several of the programme courses.

Each work period should be reported in a written report and an oral presentation. The first work period must be preceded by studies of at least 45 HE credits within the programme at Högskolan i Gävle, of which at least 30 HE credits must be passed. In order to begin the second, third and fourth work period, programme courses of at least 45 HE credits, 60 HE credits and 75 HE credits must be successfully completed.

3.4 Student Influence

There is a council for educational affairs linked to the programme, with representatives from companies and organisations, teachers and students. The council for educational affairs is advisory, and the faculty programme director is the chairman. There are student representatives in the Board of Governors, the faculty boards and in the academy councils. Gefle Student Union appoints student representatives.

3.5 Internationalisation

Högskolan i Gävle has a large international contact network and several agreements with higher education institutions and universities abroad. At the higher education institution, there is an international office that can give information about which exchanges are currently available at each given date.

3.6 Sustainable Development

An important starting point for the education is that a student must be able to view new technology from a social perspective. The student needs knowledge of and skills in managing products, processes and the working environment considering people's conditions and needs and society's targets concerning social relations, resource management, environment and economics. After the education, the student should be able take human-science and environmental requirements in problem-solving and product development into account, and have the skills to promote an environmentally adapted technology. Working methods exercising these abilities are therefore important elements in the education.

4 Courses in the Programme

The students have guaranteed admission to the courses within the programme. Course applications for the following semester must be submitted. Changes in the order of courses may be made in consultation with the students on the programme. Changes in the programme courses are made by the Faculty Board. Change of period when the course is given is determined on department level. Alternative course choices may be made in consultation with the faculty programme director, provided that the expected learning outcomes of the programme are fulfilled.

F = First-cycle

Study path according to the three-year model

Year 1

Period	Course Name	HE credits	Level	Main Field of Study
1:1	Introduction to Energy Systems	7.5	F	Energy Technology
1:2	Work Science and Environmental Technology	7.5	F	Industrial Management
1:1-2	Introduction to Cycles and Sustainable Development	15	F	Environmental Technology
1:3	Environmental Impact	7.5	F	Environmental Technology
1:3	Fundamentals of Logistics	7.5	F	Industrial Management
1:4	waste management	7.5	F	Environmental Technology
1:4	Environmental Chemistry	7.5	F	Chemistry
1:3	Linear Algebra (elective)	7.5	F	Mathematics
1:4	Calculus (elective)	7.5	F	Mathematics

Year 2

Period	Course Name	HE credits	Level	Main Field of Study
2:1	Sustainable Energy Systems	7.5	F	Energy Technology
2:1	Industrial Environmental Management	7.5	F	Industrial Management
2:1	Data Analysis and Statistics for Engineers (Elective Course)	7.5	F	Mathematical Statistics
2:2	Water and Waste Water Systems	7.5	F	Energy Technology
2:2	Management Accounting and Analysis	7.5	F	Business Administration
2:3-4	Environment, Water and Energy - Project	15	F	Environmental Technology
2:3	Perspectives on Quality and Environmental Audit	7.5	F	Environmental Technology
2:3	Linear Algebra (Elective Course)	7.5	F	Mathematics
2:4	Environmental Assessment of Energy Systems	7.5	F	Environmental Technology
2:4	Calculus (Elective Course)	7.5	F	Mathematics

Year 3

Period	Course Name	HE credits	Level	Main Field of Study
3:1	Industrial Environmental Economics and Law	7.5	F	Industrial Management
3:1	Environment and Sustainable Development in the Baltic Sea	7.5	F	Biology
3:2	Life Cycle Analysis	7.5	F	Environmental
3:2-3	Cycles and Sustainable Development - Project	15	F	Environmental Technology
3:3	Scientific Theory and Writing	7.5	F	Environmental
3:4	Degree Project	15	F	Environmental

Study path according to the Co-op model

Year 1

Period	Course Name	HE credits	Level	Main Field of Study
1:1	Introduction to Energy Systems	7.5	F	Energy Technology
1:2	Work Science and Environmental Technology	7.5	F	Industrial Management
1:1-2	Environmental Impact Assessment	15	F	Environmental Technology
1:3	Fundamentals of Logistics	7.5	F	Environmental
1:3	Waste Management	7.5	F	Industrial
1:3	Environmental Chemistry	7.5	F	Mathematics
1:4	Work period 10 weeks			

Year 2

Period	Course Name	HE credits	Level	Main Field of Study
2:1	Sustainable Energy Systems	7.5	F	Energy Technology
2:1	Industrial Environmental	7.5	F	Industrial Management
2:1	Data Analysis and Statistics for Engineers (elective)	7.5	F	Mathematical Statistic
2:2	Water and Waste Water	7.5	F	Energy Technology
2:2	Management Accounting and Analysis	7.5	F	Business Administrati
2:3	Work period 10 weeks			
2:4	Waste Management	7.5	F	Environmental
2:4	Environmental Chemistry	7.5	F	Chemistry
2:4	Calculus (elective course)	7.5	F	Mathematics

Year 3

Period	Course Name	HE credits	Level	Main Field of Study
3:1	Industrial Environmental Economics and Law	7.5	F	Industrial Management
3:1	Environment and Sustainable Development in the Baltic Sea	7.5	F	Biology
3:2	Work period 10 weeks			
3:3-4	Environment, Water and Energy - Project	15	F	Environmental Technology
3:3	Perspectives in Quality and Environmental Auditing	7.5	F	Environmental Technology
3:4	Environmental Assessment of Energy Systems	7.5	F	Environmental Technology

Year 4

Period	Course Name	HE credits	Level	Main Field of Study
4:1	Work period 10 weeks			
4:2	Life Cycle Analysis	7.5	F	Environmental
4:2-3	Cycles and Sustainable Development - Project	15	F	Environmental Technology
4:3	Scientific Theory and Writing	7.5	F	Environmental
4:4	Degree Project	15	F	Environmental

5 Entry Requirements

General entry requirements, specific entry requirements 4 and the following specific entry requirements:

Subject	Course
English	En B
Mathematics	Ma C
Social Studies	Sh A

The grade for each of the above subjects should be at least Pass.

6 Grades

Grades are given for the programme courses according to relevant course syllabus.

7 Examination Regulations

7.1 Title of Qualification

Bachelor of Arts
Filosofie kandidatexamen

Bachelor of Science in Engineering
Högskoleingenjörsexamen

7.2 Qualification Criteria

To receive a certificate for a *Bachelor of Arts* of 180 HE credits, the student must have successfully completed courses of 180 HE credits. The higher education qualification should include at least 90 HE credits with a progressive specialisation in the main field of Environmental Engineering, including a degree project of 15 HE credits.

To receive certificate for *Bachelor of Science in Engineering*, the student must have successfully completed courses of 180 HE credits. The higher education qualification should include at least 90 HE credits with a progressive specialisation in the main field of Environmental Engineering, including a degree project of 15 HE credits and at least 15 HE credits in mathematics, including 7.5 HE credits in linear algebra and 7.5 HE credits in calculus. At least 30 HE credits in technology should also be included.

7.3 Degree Certificates

Students who fulfil the requirements for a higher education qualification should receive a degree certificate on request.
Each degree certificate must be followed by a diploma supplement that describes the education and its place in the education system (the Higher Education Ordinance, chapter 6, section 15). The appendix is called Diploma Supplement. Diploma Supplement should facilitate recognition and in credit - counting of a Swedish higher education qualification at employment and continued studies abroad but also in Sweden.

For Co-op to be included in the degree certificate, all four work periods must be completed, with a total extent of at least 40 weeks.